Problems on Trains (Time and Distance)

On problems related to trains Commit to memory the following tips for solving questions easily.

Key concepts:

1. If two objects are moving in opposite directions towards each other at speeds u and v, then relative speed = Speed of first + Speed of second = u + v.
This is also the speed at which they are moving towards each other or the speed at which they may be moving away from each other.

2. If the two objects move in the same direction with speeds u and v, then
relative speed = difference of their speeds = u – v.

This is also the speed at which the faster object is either drawing closer to the slower object or moving away from the slower object as the case may be.

Important Models:

Model 1. 1 Pole and I Train:
Length of The Train (m) = Speed of the Train (m/s) × Time taken to cross the pole (s)

Model 2. 1 Train and 1 Platform:
Length of the Train + Length of the Platform (m) = Speed of the Train (m/s) × Time taken to cross the platform (s)

Model 3. 1 Train with speed speed v_1 and 1 moving person with speed v_2

Case 1: If both are moving in same direction
Length of The Train (m) = [Speed of the Train - Speed of the Man] (m/s) × Time taken to cross the man (s)

Case 2: If both are moving in opposite direction
Length of The Train (m) = [Speed of the Train + Speed of the Man] (m/s) × Time taken to cross the man (s)

Model 4. 2 Trains with speeds v_1,v_2

Case 1: If both are moving in same direction
[Length of The Train 1 + Length of the Train 2](m) = [Speed of the Train1 - Speed of the Train 2] (m/s) × Time taken to cross (s)

Case 2: If both are moving in opposite direction

[Length of The Train 1 + Length of the Train 2](m) = [Speed of the Train1 + Speed of the Train 2] (m/s) × Time taken to cross (s)

Solved Questions

1. A train running at certain speed crosses a stationary engine in 20 seconds. To find out the speed of the train, which of the following information is necessary:

a. Only the length of the train

b. Only the length of the engine

c. Either the length of the train or the length of the engine.

d. Both the length of the train and the length of the engine.

Correct Option : D

Explanation:

Since the sum of the length of the train and the length of the engine is needed, so both the lengths must be known.

2. A train overtakes two persons who are walking in the same direction in which the train is going, at the rate of 2 kmph and 4 kmph and passes them completely in 9 and 10 seconds respectively. The length of the train is :

a. 72 metres

b. 54 metres

c. 50 metres

d. 45 metres

Correct Option : C

Explanation:

Let the length of the train be x km and its speed y km/hr. Then, speed relative to first man = (y-2) km/hr.

Speed relative to second man = (y-4) km/hr.

$\frac{x}{y-2} = \frac{9}{60 \times 60}$ and $\frac{x}{y-4} = \frac{10}{60 \times 60}$

9y - 18=3600x or 10y - 40=3600x

So, 9y-18=10y-40 or y =22

$\frac{x}{22-2} = \frac{9}{3600}$ or x = $\frac{20 \times 9}{3600} = \frac{1}{20}$

= $(\frac{1}{20} \times 1000)$ m = 50 m

3. Two stations A and B are 110 kms.apart on a straight line. One train starts from A at 7 a.m and travels towards B

at 20 km per hour speed. Another train starts from B at 8.a.m and travels towards A at a speed of 25 km per hour. At what time will they meet?

a. 9 a.m

b. 10 a.m

c. 11 a.m

d. None of these.

Correct Option : B

Explanation:

Suppose they meet x hrs after 7 a.m.

Distance covered by A in x hrs = $(20 \times x)$ km

Distance covered by B in (x-1) hrs=25(x-1) km

20x+25(x-1)=110 or

45x = 135 or x = 3

So, they meet at 10 a.m

4. A train 100 metres long moving at a speed of 50 kmph crosses a train 120 metres long coming from opposite direction in 6 seconds. The speed of second train is :

a. 132 kmph

b. 82 kmph

c. 60 kmph

d. 50 kmph

Correct Option : B

Explanation:

Let the speed of the second train be x km/hr.

Relative speed = (50+x) km/hr = $[(50+x) \times \frac{5}{18}]$ m/sec =$(\frac{250+5x}{18})$ m/sec.

$\Rightarrow \frac{100+120}{\frac{250+5x}{18}} = 6$ or

$220 \times 18 = 6(250+5x)$ or 30x = 3960-1500 or x = $\frac{2460}{30} = 82$

Speed of the second train = 82 m/s.

5. Two trains are running in opposite directions with speed of 62 kmph and 40 kmph respectively. If the length of one train is 250 metres and they cross each other in 18 seconds, the length of the other train is :

a. 145 metres

b. 230 metres

c. 260 metres

d. Can not be determined

Correct Option : C

Explanation:

Let the length of the another train = x meres

Their relative speed = (62+40) km/hr = $(102 \times \frac{5}{18})$ m/sec = $(\frac{85}{3})$

$\frac{250+x}{\frac{85}{3}} = 18 \Rightarrow \frac{3(250+x)}{85} = 18$

$\Rightarrow 250+x = 510 \Rightarrow x = 260$

Length of another train = 260 m

6. A train 100 metres in length passes a milestone in 10 seconds and another train of the same length travelling in opposite direction in 8 seconds. The speed of the second train is :

a. 36 kmph

b. 48 kmph

c. 54 kmph

d. 60 kmph

Correct Option : C

Explanation:

Speed of first train = $(\frac{100}{10})$ m/sec = 10 m/sec

Let the speed of 2nd rain be x m/sec

Relative speed = (10+x) m/sec

$\frac{200}{10+x} = 8 \Rightarrow 200 = 80+8x \Rightarrow x = 15$

Speed of 2nd train = 15 m/sec

= $(15 \times \frac{18}{5})$ km/hr =54 km/hr.

7. A train travelling at 36 kmph completely crosses another train having half its length and travelling in the opposite direction at 54 kmph, in 12 seconds. If it also passes a railway platform in $1\frac{1}{2}$ minutes, the length of the platform is :

a. 560 metres

b. 620 metres

c. 700 meres

d. 750 metres

Correct Option : C

Explanation:

Let the length of slower train be x metres and the length of faster train be $(\frac{x}{2})$ meters.

Relative speed = (36+54)km/hr =$(90 \times \frac{5}{18})$ m/sec = 25 m/sec

$\frac{3x}{2 \times 25} = 12 \Rightarrow 3x = 600 \Rightarrow x = 200$ m

Length of slower train = 200 m

Let the length of platform be y metres

Then, $\frac{200+y}{36+\frac{5}{18}} = 90 \Rightarrow 200 \times y = 900$ or

y = 700 m Length of platform = 700 m

8. A train speeds past a pole in 15 seconds and speeds past a platform 100 meters long in 25 seconds. Its length in meters is :

a. 200

b. 150

c. 50

d. Data inadequate

Correct Option : B

Explanation:

Let the length of the train be x metres and its speed be y metres/sec.

Then, $\frac{x}{y} = 15 \Rightarrow y = \frac{x}{15}$

Now, $\frac{x+100}{25} = \frac{x}{15} \Rightarrow x = 150$ m

9. A 150 meter long train crosses a man walking at the speed of 6 kmph in the opposite direction in 6 seconds. The speed of the train in km/hr is :

a. 66

b. 84

c. 96

d. 106

Correct Option : B

Explanation:

Let the speed of the train be x km/hr

Relative speed = (x+6) km/hr = $[(x+6) \times \frac{5}{18}]$ m/sec

$\frac{150}{6} = \frac{(x+6) \times 5}{18}$ or 5x+30=450 or x = 84 km/hr

10. A train of length 150 metres take 10 seconds to pass over another train 100 metres long coming from the opposite direction. If the speed of the first train is 30 kmph, the speed of the second train is :

a. 54 kmph

b. 60 kmph

c. 72 kmph

d. 36 kmph

Correct Option : B

Explanation:

Relative speed = $(25 \times \frac{18}{5})$ km/hr = 90 km/hr

Speed of second train = (90-30) km/hr = 60 km/hr

11. A train moving at the rate of 36 km per hour crossesa standing man in 10 seconds. It will cross a platform 55 metres long in :

a. $5\frac{1}{2}$ seconds

b. 6 seconds

c. $7\frac{1}{2}$ seconds

d. $15\frac{1}{2}$ seconds

Correct Option : D

Explanation:

Speed = $(36 \times \frac{5}{18})$ m/sec=10 m/sec

Let the length of the train be x metres

Then, $\frac{x}{10} = 10 \Rightarrow x = 100$ m.

Time taken to cross the platform = $(\frac{100+55}{10})$ sec = $15\frac{1}{2}$ sec

12. A train crosses a platform 100 metres long in 60 seconds at a speed of 45 km per hour. The time taken by the train to cross an electric pole is :

a. 8 seconds

b. 1 minute

c. 52 seconds

d. Date inadequate.

Correct Option : C

Explanation:

Let the length of train = x metres

Speed = $(45 \times \frac{5}{18})$ m/sec = $(\frac{25}{2})$ m/sec

Distance covered in crossing the platform = (x+100) m

$(x+100) \times \frac{2}{25} = 60$ or 2x + 200 = 1500 or x = 650

Now, time taken to cross the pole = $(650 \times \frac{2}{25})$ sec = 52 sec

13. A train 300m long crossed a platform 900 m long in 1 minute 12 seconds. The speed of the train in km/hr was :

a. 45

b. 50

c. 54

d. 60

Correct Option : D

Explanation:

Distance covered in 72 seconds =(300+900)m

Speed = $(\frac{1200}{72})$ m/sec = $(\frac{50}{3})$ m/sec = $(\frac{50}{3} \times \frac{18}{5})$ km/hr = 60 km/hr

14. A train 270 metres long is moving at a speed of 25 kmph. It will cross a man coming from the opposite direction at a speed of 2 km per hour in :

a. 36 seconds

b. 32 seconds

c. 28 seconds

d. 24 seconds

Correct Option : A

Explanation:

Relative speed = (25+2) km/hr = 27 km/hr = $(27 \times \frac{5}{18})$ m/sec = $(\frac{15}{2})$ m/sec.

Time taken by the train to pass the man =$(270 \times \frac{2}{15})$ sec=36 sec

15. A train 700 m long is running at the speed of 72 km per hour. If it crosses a tunnel in 1 minute, then the length of the tunnel is :

a. 500 m

b. 550 m

c. 600 m

d. 700 m

Correct Option : A

Explanation:

Speed = $(72 \times \frac{5}{18})$ m/sec = 20 m/sec

Let the length of tunnel = x metres

Then, $\frac{700+x}{60} = 20$

$\Rightarrow 700 + x = 1200$ or x = 500 m

16. A person sees a train passing over 1 km long bridge. The length of the train is half that of the bridge. If the train clears the brdige in 2 minutes, the speed of the train is :

a. 50 km/hr

b. 45 km/hr

c. 60 km/hr

d. 30 km/hr

Correct Option : B

Explanation:

Distance covered in $(\frac{2}{60})$ hr = $(1 + \frac{1}{2})$ km = $\frac{3}{2}$ km

Distance covered in 1 hr = $(\frac{3}{2} \times \frac{60}{2})$ km = 45 km

So, speed of the train = 45 km/hr.

17. A train 50metres long passes a platform 100 metres long in 10 seconds. The speed of the train is :

a. 10 km/hr

b. 15 km/hr

c. 54 km/hr

d. 100km/hr

Correct Option : C

Explanation:

Distance covered by train in 10 sec. = (50+100)m=150 m

Speed = $(\frac{150}{10})$ m/sec = $(15 \times \frac{18}{5})$ km/hr=54 km/hr

18. A train 280 metres long is moving at speed of 60 km/hr. The time taken by the train to cross a platform 220 metres long is :

a. 20 seconds

b. 25 seconds

c. 30 seconds

d. 35 seconds

Correct Option : C

Explanation:

Speed of the train = $(60 \times \frac{5}{18})$ m/sec = $(\frac{50}{3})$ m/sec

Time taken by the train to cross the platform = Time taken by it to cover (280+220) m

= $(500 \times \frac{3}{50})$ sec = 30 sec.

19. The length of the train that takes 8 seconds to pass a pole when it runs at a speed of 36 km/hr, is :

a. 288 metres

b. 45 metres

c. 48 metres

d. 80 metres

Correct Option : D

Explanation:

Speed = $(36 \times \frac{5}{18})$ m/sex = 10 m/sec

Distance = $(\text{Time} \times \text{Speed})$ = (8×10) m = 80m

20. A train running at the speed of 45 kmph took 12 seconds in passing a certain point. Then the length of the train must be :

a. 90 metres

b. 120 metres

c. 150 metres

d. 540 metres

Correct Option : C

Explanation:

Speed = $(45 \times \frac{5}{18})$ m/sec = $(\frac{25}{2})$ m/sec

Distance = $(\text{Time} \times \text{Speed})$ = $(12 \times \frac{25}{2})$, = 150 m

Length of the train = 150 m

21. A train 300 metres long passes a standing man in 15 seconds. The speed of the train is :

a. 40 km/hr

b. 50 km/hr

c. 60 km/hr

d. 72 km/hr

Correct Option : D

Explanation:

Speed = $\frac{\text{Distance}}{\text{Time}} = (\frac{300}{15})$ m/sec = 20 m/sec

= $(20 \times \frac{5}{18})$ km/hr=75 km/hr

22. A train 250 metres long, running with a speed of 50 km/hr will pass an electric pole in :

a. 30 seconds

b. 18 seconds

c. 72 seconds

d. 60 seconds

Correct Option : B

Explanation:

Speed of the train = $(50 \times \frac{5}{18})$ m/sec = $(\frac{125}{9})$ m/sec

Time taken by the train to pass the pole = $(250 \times \frac{9}{125})$ sec = 18sec

23. A speed of 16 metres per second is the same as :

a. 40.3 km/hr

b. 57.6 km/hr

c. 51.16 km/hr

d. None of these

Correct Option : B

Explanation:

16 m/sec = $(16 \times \frac{18}{5})$ km/hr = 57.6 km/hr

24. A train 75 metres long is running with a speed of 20 km/hr. It will pass a standing man in :

a. 12 seconds

b. 13.5 seconds

c. 14 seconds

d. 15.5 seconds

Correct Option : B

Explanation:

Speed of the train = $(20 \times \frac{5}{18})$ m/sec = $(\frac{50}{9})$ m/sec

Time taken by the train to pass the man = $(75 \times \frac{9}{50})$ sec =13.5sec

25. A train moves with the speed of 180 km/hr then its speed in metres per second is :

a. 5

b. 30

c. 40

d. 50

Correct Option : D

Explanation:

180 km/hr = $(180 \times \frac{5}{18})$ m/sec = 50 m/sec

Additional Questions:

26. A train running at 54 km/hr takes 20 s to cross a platform and 12 s to pass a man walking in the same direction at a speed of 6 km/hr. Find the length of the train and the platform.

Let the length of the train = x m. Let the length of the platform = y m.

Speed of the train relative to the man = 54 - 6 = 48 km/hr X $\frac{5}{18}$ = $\frac{40}{3}$ m/s

In passing the man, the train covers its own length with relative speed.

Length of the train = $\frac{40}{3}$ × 12 = 160 m.

Now Length of the Train + Length of the Platform (m) = Speed of the Train (m/s) X Time taken to cross the platform (s)

Speed of train = 54 km/hr X $\frac{5}{18}$ = 15 m/s

160 + y = 15 X 20

Length of the platform = 140 m.

27. A man standing on a railway platform notices that a train going in one direction takes 10 seconds to pass him and other train of the same length takes 15 seconds to pass him. Find the time taken by the two trains to cross each other when they are running in the opposite directions.

Time taken = $\frac{2ab}{a+b} = \frac{2 \times 10 \times 15}{25}$ = 12 seconds

28. A man standing on a railway platform notices that a train going in one direction takes 9 seconds to pass him and other train of the same length takes 6 seconds to pass him. Find the time taken by the two trains to cross each other when they are running in the same direction.

Time taken = $\frac{2ab}{a-b} = \frac{2 \times 9 \times 6}{3}$ = 36 seconds

29. Two trains start at the same time from two stations and proceed towards each other at the speed of 15 km and 20 km per hour respectively. When the trains meet, it is found that one train has travelled 50 km more than the other. Find the distance between the two stations.

In one hour, faster train travels (20 - 15) = 5 km more than the shower.

In 10 hours, faster train travels 50 km more than the slower.

In one hour, distance covered by the two trains = (15 + 20) = 35 km

Therefore, Total distance covered in 10 hours = 10 x 35 = 350 km.

30. The distance between two stations A and B is 300 km. One train leaves station A towards station B at the average speed of 40 km/h. At the same time, another train left station B towards A at the average speed of 80 km/h. The distance from station A where the two trains meet is:

Ratio of distance covered = Ratio of speeds = 40 : 80 = 1 : 2

Therefore, Distance covered are 100 km and 200 km respectively.

Therefore, Distance from station a = 100 km.

31. A train leaves station A towards B at an average speed of 60 km/h at 9 a.m., after 2 hours another train leaves station A at an average speed of 100 km/h. When the two trains will meet?

Distance covered by the first train in 2 hours = 2 x 60 = 120 km.

Second train gains = 100 - 60 = 40 km/h

Therefore, Second train will gain 120 km in $\frac{120}{40}$ = 3 hours.

Therefore, They will meet at 9 a.m. + 2 hours + 3 hours = 2 p.m.